

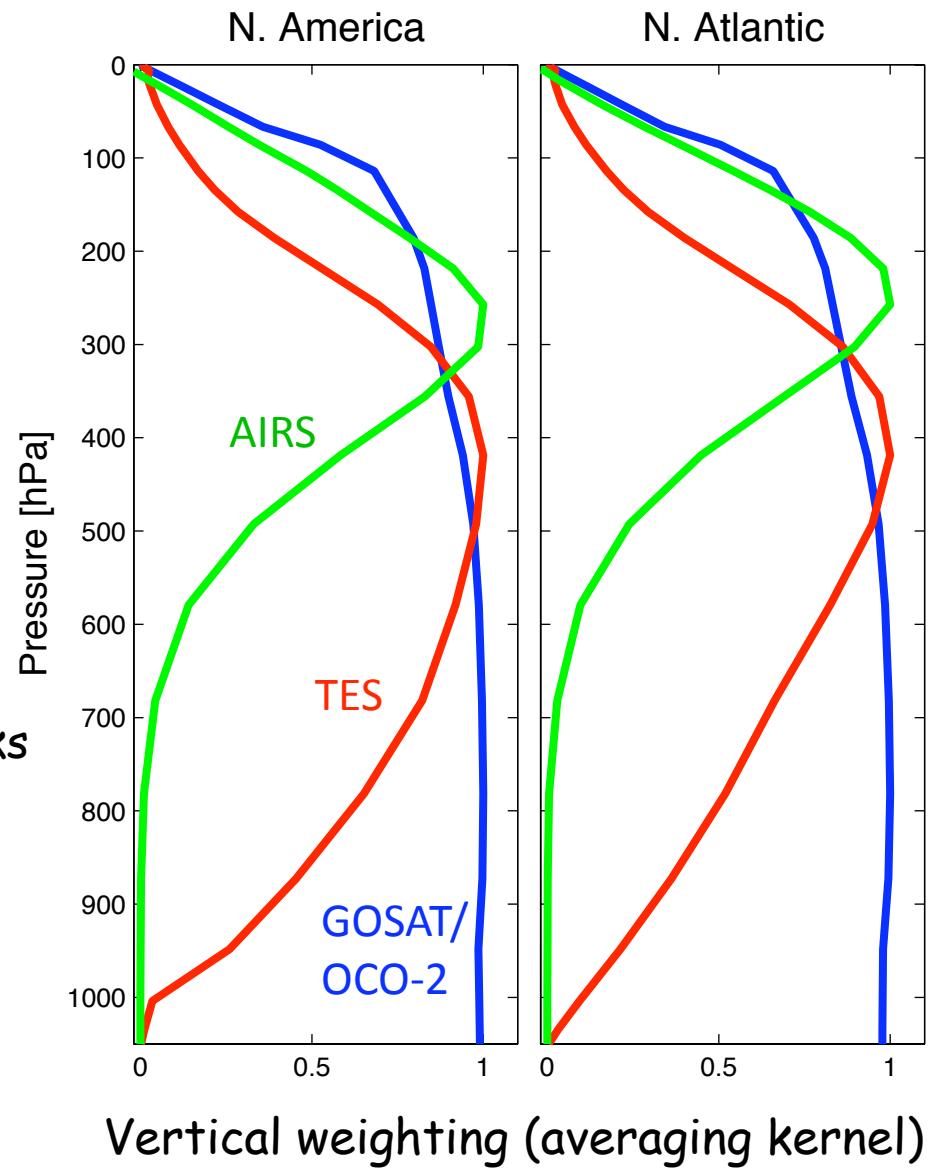
Comparison of AIRS and GOSAT CO₂ retrievals to GEOS5-driven modeled fields at ~50 km resolution

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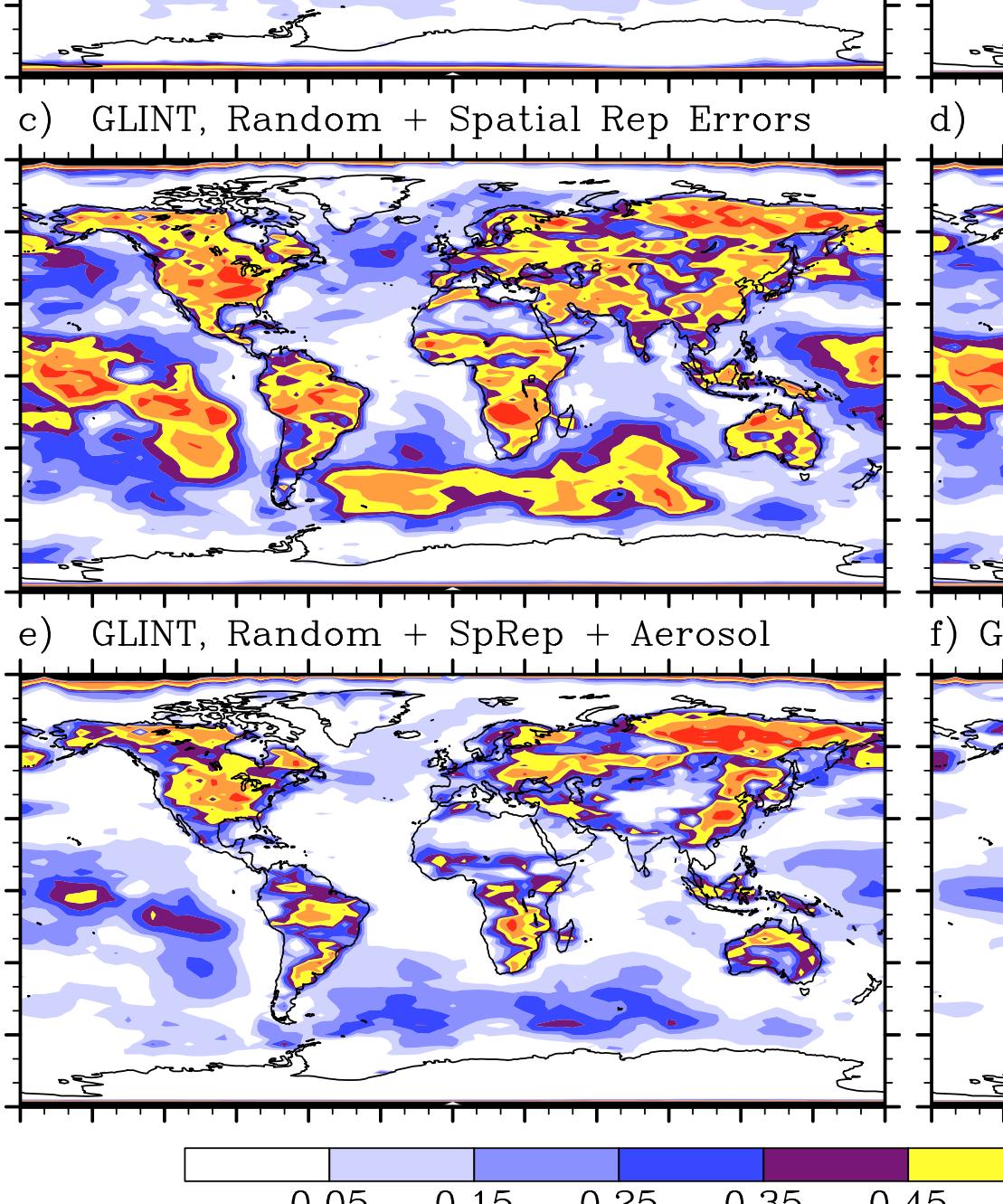
Collaborators: Nick Parazoo, Denis O'Brien, Chris O'Dell, Scott Denning, Andy Jacobson, Ed Olsen, Ivan Lima, Scott Doney, Randy Kawa, Stephen Pawson

Why measure CO_2 from satellites?

- Enough spatial/temporal coverage to pin down regional carbon sources/sinks
→ insight into dominant processes in global carbon cycle
- Column CO_2 complements the (mostly surface) *in situ* data, helps mitigate transport model errors
- Reflected solar IR bands (GOSAT/OCO-2) give near-surface information best for constraining regional sources/sinks
- Thermal IR (AIRS, TES, IASI) better at providing an integral constraint on coarser spatial scales, longer time scales
- Difference thermal and near IR to get even more information close to surface



- Before assimilating satellite data, IDENTIFY/REMOVE systematic errors!
 - Biases must be reduced down to < 0.5 ppm
 - Better if random errors down to < 2 ppm level
- Satellite data:
 - ~10,000 ACOS GOSAT X_{CO_2} retrievals, Apr-Dec 2009
 - 12 days worth of AIRS CO_2 retrievals from the (6,16,26)th of (Jan,Apr,Jul,Oct), 2009
- Compare to good forward model:
 - GEOS5-driven off-line PCTM transport, $\frac{1}{2}^\circ \times \frac{2}{3}^\circ$ (lat/lon), 40 vertical layers
 - GEOS5-driven, diurnally-varying SiB3 land biospheric fluxes, $\frac{1}{2}^\circ \times \frac{2}{3}^\circ$
 - Annually-varying fossil fuel, $\frac{1}{2}^\circ \times \frac{2}{3}^\circ$
 - Monthly- and annually-varying ocean fluxes (Doney model)
 - Run for 1992-2010 to develop good gradients into stratosphere



Fractional reduction in uncertainty
in weekly flux estimates from OSSEs
of Orbiting Carbon Observatory data

AIRS - CarbonTracker upper-tropospheric CO_2 difference [ppm]
vs. cloud top pressure, eight N/S swaths, 2008

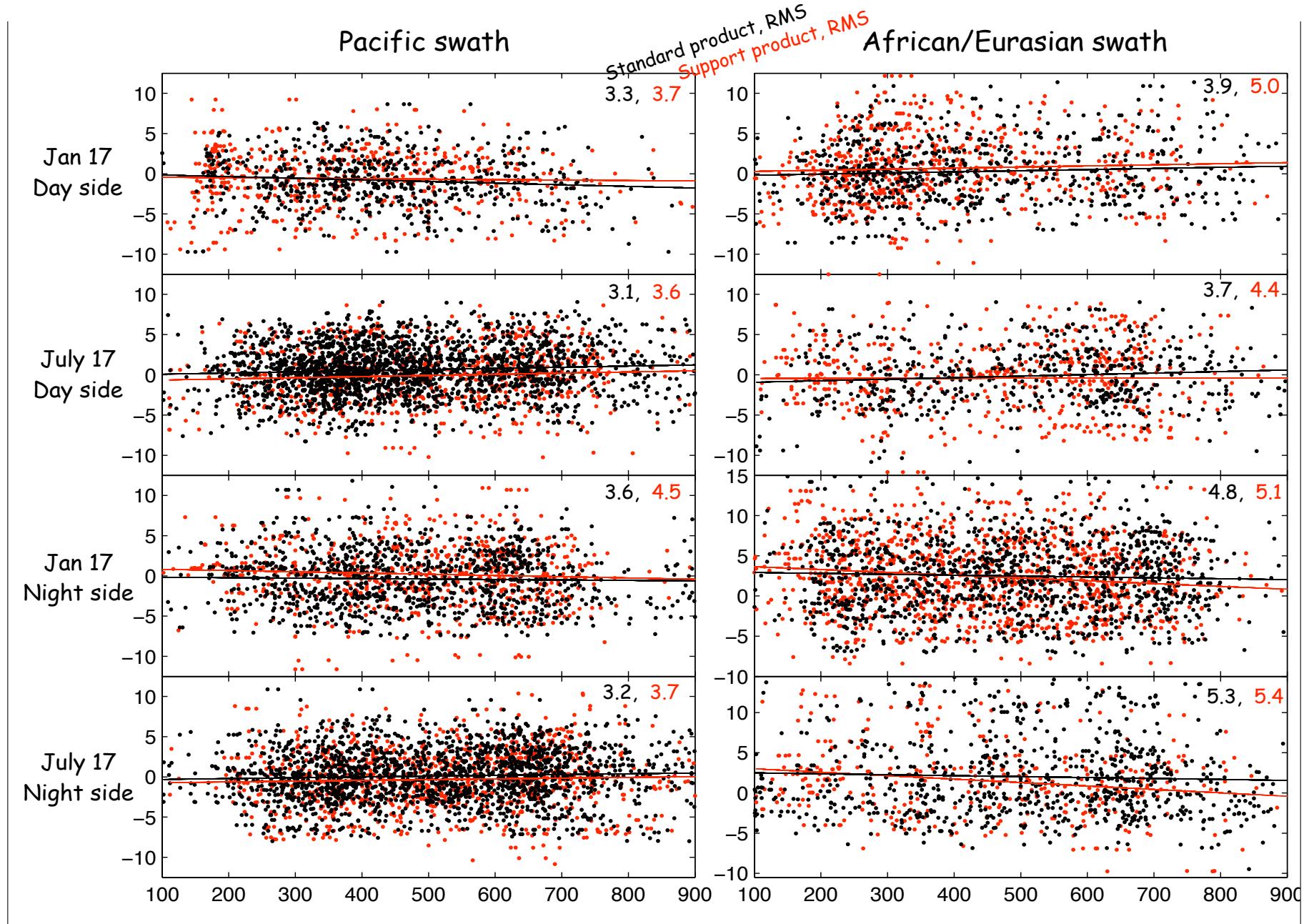
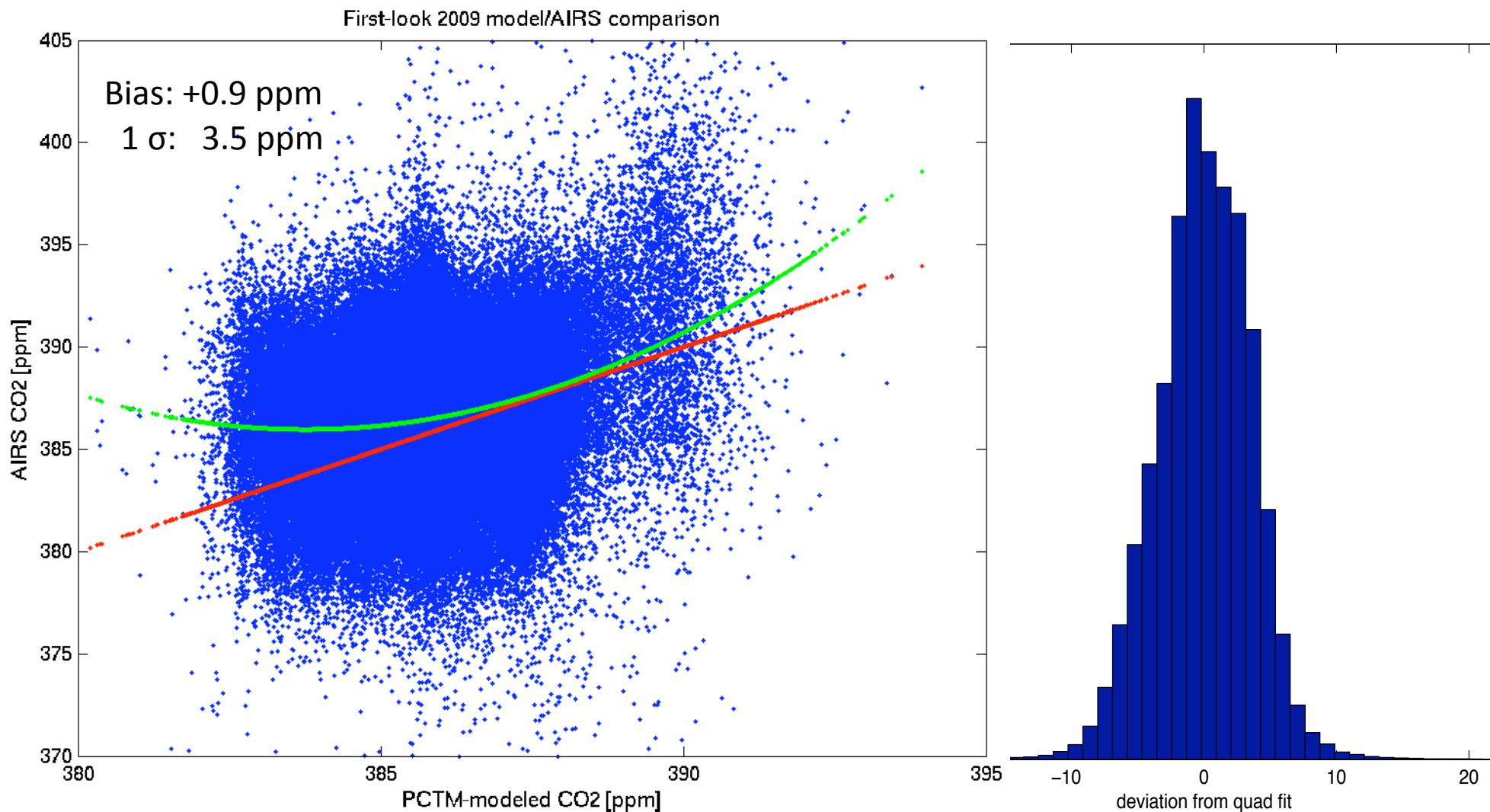
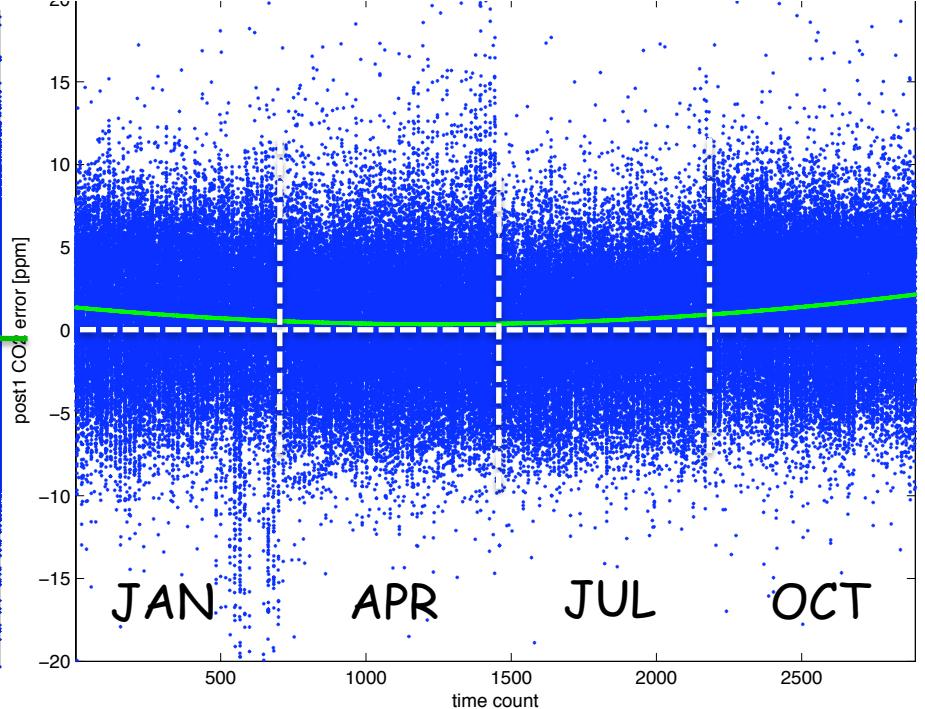
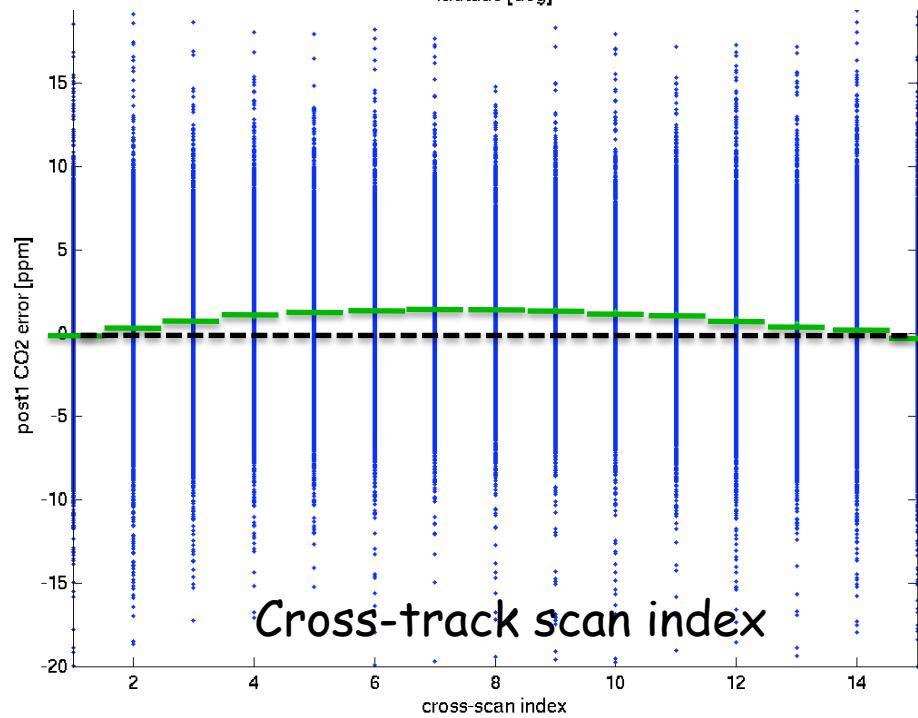
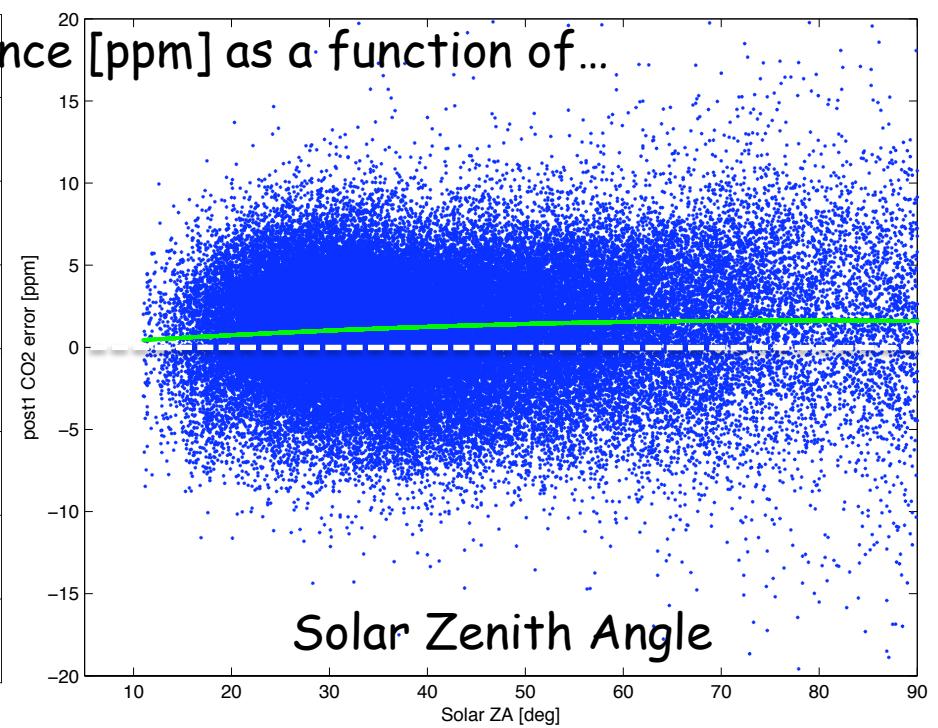
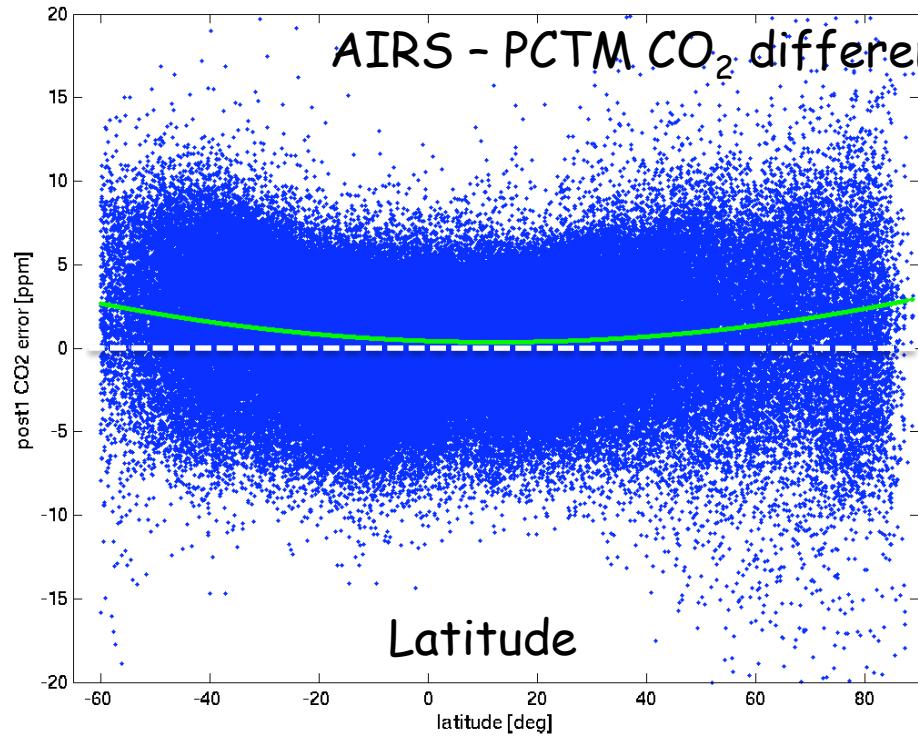


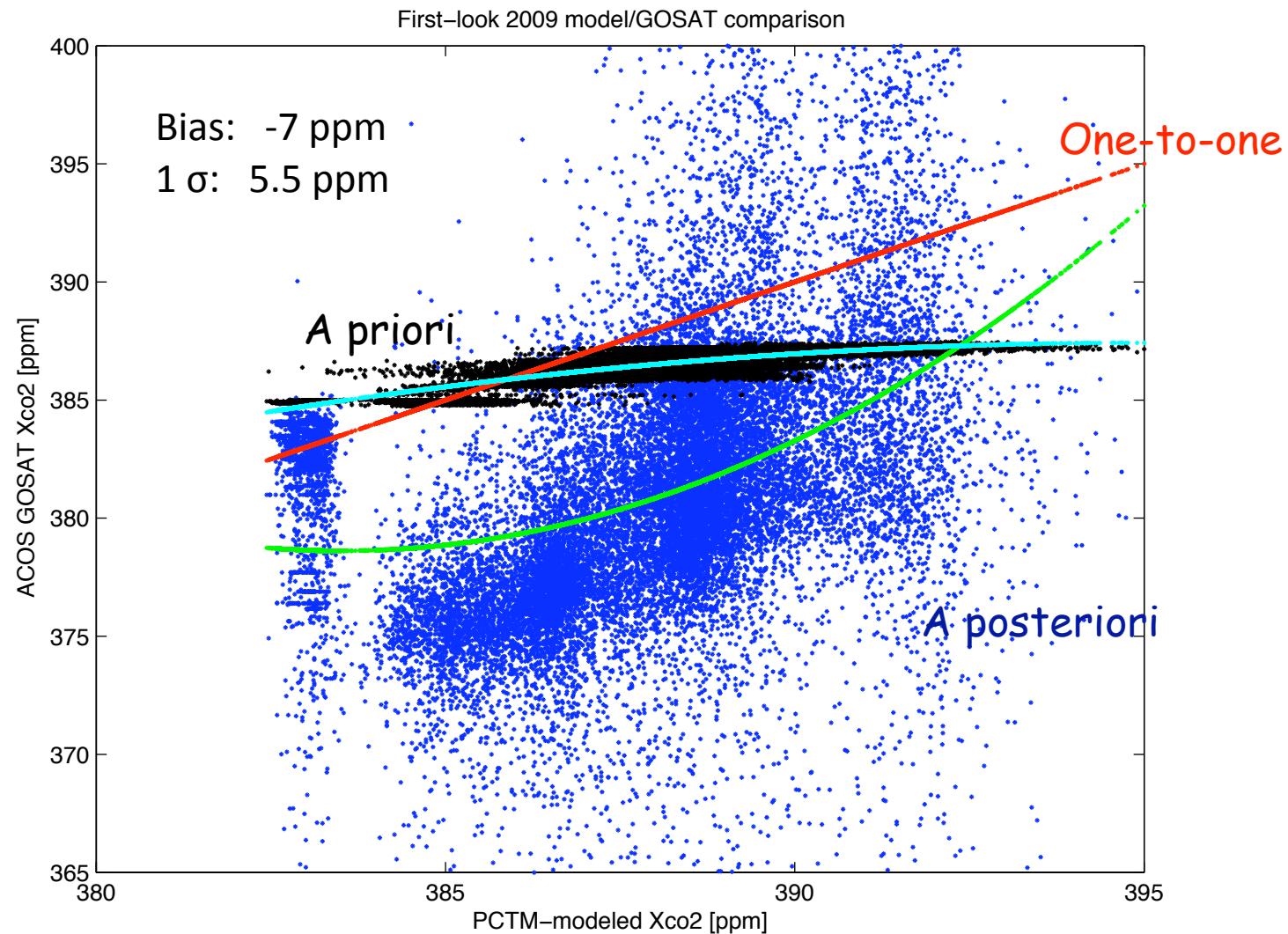
Figure 2
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AIRS - PCTM CO₂ difference (individual retrievals),
12 days, (6,16,26)th of (Jan, Apr, Jul, Oct), 2009

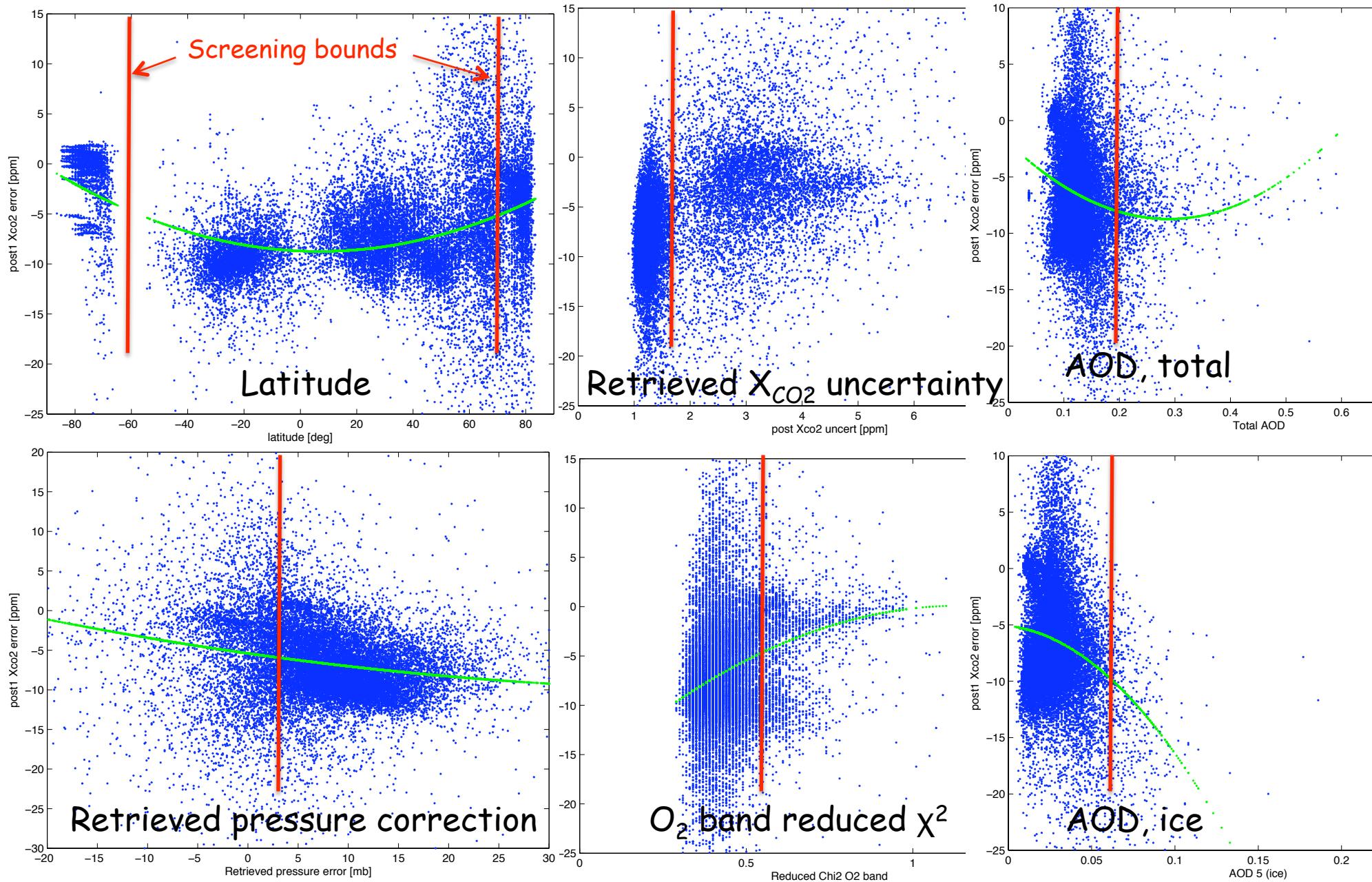




ACOS GOSAT - PCTM CO_2 difference [ppm] (before screening)



ACOS GOSAT - PCTM CO_2 difference [ppm] as a function of...



ACOS GOSAT - PCTM CO_2 difference [ppm] (after screening)

